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ACTUARIAL VALUATION

AS OF

JULY 1, 1988

Hendrickson, Miller  
& Associates, Inc.  
ACTUARIAL CONSULTANTS



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## SECTION I

### INTRODUCTION

An actuarial valuation of the Public Employees' Retirement System of the State of Montana has been completed as of July 1, 1988. This valuation was authorized by the Public Employees' Retirement Board under Section 19-3-305, MCA. The purpose of the valuation was to determine the financial position of the fund, the normal cost, and the unfunded accrued liability based upon present and prospective assets and liabilities of the system as of July 1, 1988.

Section II presents an analysis of the results of the actuarial valuation. The numerical findings and membership data supporting this analysis are shown in Section III.

In conducting the actuarial valuation, certain assumptions were made as to the future experience of the system. A summary and discussion of each of the assumptions is contained in Section IV.

The valuation is based upon the Public Employees' Retirement Act and incorporates all amendments as of July 1, 1988. A summary of the major provisions of the Act is contained in Section V.

### ACTUARIAL CERTIFICATION

The results of the actuarial valuation shown in this report are based upon information provided by the Public Employees' Retirement Division regarding plan participants, plan assets and other matters. The values have been calculated on the basis of actuarial assumptions which, in my opinion, are appropriate for purposes of this valuation.

This valuation has been prepared in accordance with generally accepted actuarial principles and practices and, to the best of my knowledge, fairly reflects the actuarial position of the Public Employees' Retirement System as of July 1, 1988.

-----  
Alton P. Hendrickson  
Member, American Academy  
of Actuaries

## SECTION II

### ANALYSIS OF VALUATION

#### RESULTS OF VALUATION

The actuarial valuation as of July 1, 1988 has determined that the percentage of each member's salary required to fund the benefits as they accrue in the future is 9.376%. The regular contribution rate of 12.417% allows 3.041% to be applied to the unfunded past service liability. This percentage is sufficient to amortize the unfunded past service liability over a period of 24.96 years. This period has decreased from 28.24 years in 1986.

An amortization schedule has been prepared which will fund the liability as of July 1, 1984 over a remaining period of 36 years. The liability attributable to 1986 will be amortized over a remaining period of 38 years. A new liability of \$6,234,637 was determined as of July 1, 1988. This will be amortized over a 40-year period. The total contribution rate as a percentage of salary required to meet this schedule is 11.648%. This is a decrease from the required rate of 11.836% in 1986. The schedule is illustrated on page 8.

The variations between this valuation and that of July 1, 1986 are the results of the experience of the Public Employees' Retirement System versus the expected, as well as a change in the actuarial assumptions.

#### ACTUARIAL MODIFICATIONS

A report was prepared on noneconomic actuarial assumptions as of June 30, 1987. This report recommended changes in the mortality, disability, withdrawal and retirement rates assumptions. These assumptions were approved by the board as discussed below.

- a. Mortality Rates. Since 1978, the basis for mortality assumptions had been the 1971 Group Annuity Mortality Table. These rates were set back one year to reflect increased longevity. The new mortality basis is the 1983 Group Annuity Mortality Table which reflects recent experience on a national basis. This table is more conservative than the previous basis and anticipates increased longevity.

This change increased the system's liability by \$13 million and increased the funding period by 1.4 years.

- b. Disability. Previous disability rate assumptions were based upon rates published by the Railroad Retirement Board in its seventh valuation of its retirement system. These rates anticipated disabilities higher than actually experienced by the Public Employees' Retirement System. The new basis is the 1983 Disability Table which anticipates fewer disabilities.

This change decreased the system's liability by \$1 million and decreased the funding period .1 year.

- c. **Withdrawal Rates.** The previous withdrawal rates assumptions understated the actual rate of withdrawal in anticipation of members returning to employment and receiving credit for past years under the Public Employee Retirement System. The new rates are based upon the actual experience of the system during the 4-year period of investigation and fairly represent the withdrawal rates from the system. In conjunction with this change, assumptions were also made regarding members' ability to purchase credit for additional service including previous period of employment. This assumption provides that vested members who are not yet eligible for retirement will purchase additional credit of 2 years of service on the average.

This change increased the system's liability by \$7 million and increased the funding period by 3.1 years.

- d. **Retirement Rates.** New retirement age assumptions have decreased the age at which members are anticipated to retire. It is expected that the ability to purchase out-of-state service credit will contribute to this reduction.

This change decreased the system's liability by \$2 million and reduced the funding period by 1.1 year.

The future salary increase assumption continues at 6 1/2% per annum. No provision was made for a select rate at a lower level for the next few years. Also, the meritorious and longevity increase assumption of 3/4 of 1% has been eliminated. The net impact of this change was a decrease in the system's liability of \$33 million and a reduction in the funding period of 4.7 years.

As noted in this report, a portion of the market value appreciation on stocks was recognized in this valuation. The result was a reduction of 2.2 years in the amortization period of the unfunded liability.

The overall effect of the actuarial assumption modifications was a decrease in the system's liability of \$15 million and a reduction in the funding period of 3.68 years. Had these changes not been made, the funding of the unfunded liability would have occurred over a 28.64-year period compared to 24.96 as determined by this valuation.

#### SUMMARY OF DATA

The active membership increased by 424 members from 26,767 in 1986 to 27,191 in 1988. The total payroll increased 1.6% to \$466 million. The average annual salary remained constant at \$17,145.

The number of members receiving benefits increased from 8,406 in 1986 to 9,224 in 1988. The average monthly benefit increased 9.4% from \$362 in 1986 to \$396 in 1988. The combined effect of more recipients and larger benefits resulted in a 20.2% increase in the annual benefits. The total annual benefit payout as of July 1, 1988 was \$44 million.

The fund balance of the Public Employees' Retirement System as of June 30, 1988 was \$693 million less the market value appreciation on stocks. This represented a 27.8% increase over the similar fund balance as of 1986. The market value appreciation on stocks was \$65,752,297. We recommend that any market value gain or loss be recognized in the valuation and spread over a 3-year period to eliminate drastic fluctuation. For purposes of this valuation, we recognized 1/3 of this appreciation and used a total asset value of \$715 million.

There are 12,075 male members of the system and 15,116 female members for a total of 27,191. The average member is 42 years old, was employed at age 35, and has completed 7 years of service. This member has a salary of \$17,145 and has contributed a total of \$6,178 with a current account balance of \$9,430 including interest.

There are 9,224 members receiving benefits of which 4,790 are males and 4,434 are females. The average member is 69 years old, has completed 18 years of service and receives a monthly benefit of \$396. The average member who retired since the last valuation is age 62, completed 18 years of service and receives a monthly benefit of \$494.

#### CONCLUSION

As anticipated, the liabilities and assets of the system continue to grow. Significant actuarial changes were made in this valuation. Some changes added liabilities, others reduced them. The net effect indicates that the system continues to make good progress. Identification of biennial liability changes and funding will allow for better recognition of liability changes in future years.

SECTION III  
Public Employees' Retirement System

SCHEDULE 1  
NORMAL COST ALLOCATION

(1) Normal Cost Contribution Rate:	
(a) Retirement	6.364%
(b) Death	0.204
(c) Disability	0.336
(d) Vested	1.381
(e) Withdrawals	1.091
	-----
(f) Total Rate	9.376%
 (2) Present Value of Future Salaries Of Current Members	 \$3,446,149,867
 (4) Present Value of Future Normal Costs For Current Members (1(f) * (2))	 \$ 323,111,012



Public Employees' Retirement System

SCHEDULE 2

PRESENT VALUE OF BENEFITS

(1) Present Value of Benefits - Inactive Members

(a) Retirement	\$ 343,209,600
(b) Death	9,811,556
(c) Disability	30,836,920
(d) Vested	7,105,927
(e) Withdrawals	2,154,800
	-----
(f) Total Inactive	\$ 393,118,803

(2) Present Value of Benefits - Active Members

(a) Retirement	\$ 705,760,605
(b) Death	15,572,552
(c) Disability	23,869,678
(d) Vested	128,394,070
(e) Withdrawals	69,568,775
	-----
(f) Total Active	\$ 943,165,680
	-----

(3) Total Liabilities \$1,336,284,483

Public Employees' Retirement System

SCHEDULE 3

LIABILITY ALLOCATION AND STATUTORY FUNDING

(1) Unfunded Past Service Liability

(a) Present Value of Benefits	\$1,336,284,483
(b) Present Value of Future Normal Costs	\$ 323,111,012
(c) Fund Assets	\$ 714,661,780 -----
(d) Unfunded Liability (a)-(b)-(c)	\$ 298,511,691

(2) Contribution Rates Amortized over 24.96 Years

(a) Present Value of Salaries During Next 24.96 Years	\$ 9,816,235,198
(b) Unfunded Contribution Rate $1(d)/2(a)$	3.041%
(c) Normal Cost Rate (Schedule 1)	9.376 -----
(d) Statutory Funding Rate	12.417%

Public Employees' Retirement System

SCHEDULE 4

UNFUNDED LIABILITY AMORTIZATION SCHEDULE

(1) 1984 Unfunded Past Service Liability Account

(a) 1984 Liability Account as of 7/1/86	\$ 305,866,032
(b) Interest Charge on Liability Account	50,896,106
(c) Contributions during Biennium	
Allocated to Unfunded Liability	29,634,516
(d) Interest Credit on Contributions	2,285,414
	-----
(e) 1984 Liability Account as of 7/1/88	\$ 324,842,208

(2) 1986 Unfunded Past Service Liability Account

(a) 1986 Liability Account as of 7/1/86	\$ -30,662,835
(b) Interest Charge on Liability Account	-5,102,296
(c) Contributions during Biennium	
Allocated to Unfunded Liability	-2,970,864
(d) Interest Credit on Contributions	-229,113
	-----
(e) 1986 Liability Account as of 7/1/88	\$ -32,565,154

(3) Actuarial Gain/Loss

(a) Actual Unfunded Liability (Schedule 3)	\$ 298,511,691
(b) 1984 Liability Account as of 7/1/88	324,842,208
(c) 1986 Liability Account as of 7/1/88	-32,565,154
	-----
(d) 1988 Liability Account as of 7/1/88	\$ 6,234,637

(4) Required Contribution Rate

(a) Normal Cost Rate (Schedule 1)	9.376%
(b) Rate to Fund 1984 Liability Account Over 36-Year Period	2.465
(c) Rate to Fund 1986 Liability Account Over 38-Year Period	-0.237
(d) Rate to Fund 1988 Liability Account Over 40-Year Period	0.044
	-----
(e) Total Contribution Rate	11.648%

Public Employees' Retirement System

SCHEDULE 5  
VALUATION COMPARISON

	1986	1988
Present Value of Total Benefits		
Total	\$1,202,123,897	\$1,336,284,483
Average for all Members	34,177	36,696
Unfunded Past Service Liability		
Total	\$ 275,203,197	\$ 298,511,691
Average for all Members	7,824	8,197
Assets		
Total	\$ 558,989,899	\$ 714,661,780
Average for all Members	15,892	19,625
Annual Salary		
Total	\$ 458,946,027	\$ 466,179,564
Average for Active Members	17,146	17,145
Normal Cost Contribution Rate	9.557%	9.376%
Recommended Contribution Rate for Unfunded Past Service Liability	<u>2.860%</u>	<u>3.041%</u>
Total Recommended Contribution Rate	12.417%	12.417%

Public Employees' Retirement System

SCHEDULE 6

COMPARISON OF MEMBERSHIP

CONTRIBUTING MEMBERS

	<u>1986</u>	<u>1988</u>
Number of Members	26,767	27,191
Total Annual Salaries	\$458,946,027	\$466,179,564
Average Annual Salaries	\$ 17,146	\$ 17,145

MEMBERS RECEIVING BENEFITS

	<u>1986</u>	<u>1988</u>
Number of Lives		
Retired	7,528	8,252
Disabled	686	762
Survivor	<u>192</u>	<u>210</u>
Total	8,406	9,224

Annual Benefit Payments

Retired	\$32,654,844	\$39,336,259
Disabled	2,846,251	3,351,179
Survivor	<u>981,043</u>	<u>1,155,766</u>
Total	\$36,482,138	\$43,843,204

Average Monthly Benefit Payments

Retired	\$361	\$397
Disabled	346	366
Survivor	<u>426</u>	<u>459</u>
Total	\$362	\$396

# SCHEDULE 7

## TABLE 1

Public Employees' Retirement System

Number of Active Members

Completed Years of Service	Under 25	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	OVER 65	Total
0-4	1111	2079	2549	2532	1977	1325	844	581	309	148	13455
5-9	19	548	1116	1236	1053	874	733	535	326	140	6580
10-14		27	442	820	665	549	498	424	294	103	3822
15-19			13	230	412	332	253	312	224	61	1837
20-24				3	106	201	180	200	126	24	840
25-29					9	93	109	118	62	13	404
30-34						7	81	65	26	10	189
35-39							8	23	17	4	52
40-UP								1	8	3	12
TOTAL	1130	2654	4120	4821	4222	3381	2706	2259	1392	506	27191

TABLE 2  
Public Employees' Retirement System  
Average Salaries of Active Members

Completed Years of Service	Under 25	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	OVER 65	Total
0-4	13341	14782	14956	14793	14712	14531	14256	14175	14651	12007	14570
5-9	13904	17029	18888	18893	17566	16351	16093	15246	16044	12566	17288
10-14		19161	20778	23030	22752	19570	18007	18003	17297	14780	20321
15-19			20278	23557	25903	23939	20941	20049	19393	16812	22441
20-24				21180	26374	27096	23517	21834	21336	16391	23794
25-29					30151	27510	27737	24361	23151	19970	25799
30-34						29375	29858	28095	24548	23993	28193
35-39							33527	28441	25203	16094	27215
40-UP								36398	29167	21966	27970
TOTAL	13351	15290	16663	17667	18108	17878	17752	17724	17680	14046	17145

TABLE 3  
Public Employees' Retirement System  
Annual Salaries of Active Members  
In Thousands

Completed Years of Service	Under 25	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	OVER 65	Total
0-4	14822	30731	38123	37455	29085	19253	12033	8235	4527	1777	196041
5-9	264	9332	21079	23351	18497	14291	11796	8157	5230	1759	113756
10-14		518	9184	18884	15130	10744	8968	7633	5085	1523	77669
15-19			264	5418	10672	7947	5298	6256	4344	1025	41224
20-24				63	2796	5446	4233	4367	2688	393	19986
25-29					272	2558	3024	2875	1436	260	10425
30-34						206	2419	1826	639	240	5330
35-39							268	655	429	65	1417
40-UP								36	233	66	335
TOTAL	15086	40581	68650	85171	76452	60445	48039	40040	24611	7108	466183



TABLE 4  
Public Employees' Retirement System  
Number of Vested Inactive Members

Completed Years of Service	Under 25	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	OVER 65	Total
0-4											
5-9		3	17	28	28	43	46	40	14	18	237
10-14			1	5	9	17	25	20	16	8	101
15-19					1	9	6	4	4		24
20-24							5	2	2	1	10
25-29								1		1	2
30-34										1	1
35-39											
40-UP										1	1
TOTAL		3	18	33	38	69	82	67	36	30	376

TABLE 5  
Public Employees' Retirement System  
Summary of Retirees

Number of Members								
Age Group								
Under 55	55-59	60-64	65-69	70-74	75-79	80-84	Over 84	Total
196	445	1274	2161	1922	1288	615	351	8252

Total Monthly Benefit								
Age Group								
Under 55	55-59	60-64	65-69	70-74	75-79	80-84	Over 84	Total
129995	264570	620402	908158	656149	402548	186940	109261	3278023

Average Monthly Benefit								
Age Group								
Under 55	55-59	60-64	65-69	70-74	75-79	80-84	Over 84	Total
663	595	487	420	341	313	304	311	397

TABLE 6  
Public Employees' Retirement System  
Summary of Disabled

Number of Members								
Age Group								
Under 55	55-59	60-64	65-69	70-74	75-79	80-84	Over 84	Total
169	105	149	118	87	65	42	27	762

Total Monthly Benefit								
Age Group								
Under 55	55-59	60-64	65-69	70-74	75-79	80-84	Over 84	Total
60900	39118	56838	43158	33794	22243	14133	9082	279265

Average Monthly Benefit								
Age Group								
Under 55	55-59	60-64	65-69	70-74	75-79	80-84	Over 84	Total
360	373	381	366	388	342	336	336	366

TABLE 7  
Public Employees' Retirement System  
Summary of Survivors

Number of Members								
Age Group								
Under 55	55-59	60-64	65-69	70-74	75-79	80-84	Over 84	Total
34	29	34	30	28	19	20	16	210

Total Monthly Benefit								
Age Group								
Under 55	55-59	60-64	65-69	70-74	75-79	80-84	Over 84	Total
14216	16033	16331	13541	12723	8968	8163	6339	96314

Average Monthly Benefit								
Age Group								
Under 55	55-59	60-64	65-69	70-74	75-79	80-84	Over 84	Total
418	553	480	451	454	472	408	396	459

## SECTION IV

### ACTUARIAL FUNDING METHOD AND ASSUMPTIONS

The true cost of the Public Employees' Retirement System will be determined by its future experience. In determining the financial requirement of the fund, certain assumptions were made as to the expected future experience. This section summarizes the funding method applied as well as the basic assumptions used.

Any variations in the actual experience of the fund from those assumed in this valuation may cause changes in the projected future costs of the fund. It is therefore necessary that the actuarial assumptions be reviewed from time to time with adjustments as experience warrants. It is also important that regular valuations be performed to determine the financial effect of variations between the actual and assumed experience.

The assumptions shown below were based upon the past experience of the fund together with the projections as to future experience.

#### FUNDING METHOD

The method of funding employed is commonly referred to as the entry age normal cost method. This method establishes a normal cost of each fund as well as an unfunded accrued liability. The normal cost is the level percentage of total salaries required to fund the benefits, assuming this percentage has been contributed since each member's entry into the fund.

The unfunded accrued liability represents the excess of the present value of total liabilities over the present assets of the fund and the present value of expected future contributions for the normal cost.

In order to maintain the fund on an actuarially sound basis, the rate of contribution should be such as to meet the normal cost in addition to making progress towards the amortization of the unfunded liability.

## DISCUSSION OF ACTUARIAL ASSUMPTIONS

### Mortality Rates

The mortality rates for males and females are based upon the 1983 Group Annuity Mortality Table, and apply to both active members and those receiving benefits. These rates have longer life expectancies than the 1971 Group Annuity Table used in the previous valuation.

### Disability Rates

The disability rates for males and females are based upon the 1983 Disability Table and anticipate fewer disabilities than the previous rates as published by the Railroad Retirement Board.

### Withdrawal Rates

The withdrawal rates are based upon the actual experience of the system as determined in the 1987 withdrawal experience study.

### Salary Scale

The rates of salary increase are based upon an assumed compounded growth rate of 6.5% per annum.

### Investment Earnings

It was assumed that the investment earnings would be 8% compounded annually.

### Administrative Expenses

It was assumed that the system would incur no administrative expenses beyond those provided by investment earnings in excess of 8% and the \$1 per member charge.

### Termination Benefits

It was assumed that all members terminating with less than five years of service would receive an immediate withdrawal of their member contributions with interest. It was further assumed that members with five or more years of service would select the most advantageous benefits under the given assumptions.

## ILLUSTRATION OF ACTUARIAL ASSUMPTIONS

### Mortality Rates

The mortality rates are based upon the 1983 Group Annuity Mortality Table.

Age	Deaths Per 10,000	Deaths Per 10,000
	<u>Male Members</u>	<u>Female Members</u>
25	5	3
30	6	3
35	9	5
40	12	7
45	22	10
50	39	16
55	61	25
60	92	42
65	156	71
70	275	124
75	446	240
80	741	429
85	1,148	699

### Disability Rates

The disability rates are based upon the 1983 Disability Table.

Age	Disabilities per 10,000	Disabilities per 10,000
	<u>Male Members</u>	<u>Female Members</u>
25	1	1
30	2	3
35	3	5
40	6	9
45	12	15
50	20	22
55	51	41
60	105	87

### Withdrawal Rates

The withdrawal rates illustrated below reflect the turnover experienced by the Public Employees' Retirement System.

Age	Withdrawals Per 10,000	Withdrawals Per 10,000
	-----Male Members-----	-----Female Members-----
25	1,686	2,203
30	1,150	1,514
35	757	996
40	565	776
45	460	632
50	354	489
55	259	374
60	172	259

### Salary Scale

The salary increases are based upon an assumed compounded growth rate of 6.5% per annum.

### Investment Earnings

Future investment earnings are assumed to be 8% compounded annually.

### Administrative Expenses

It was assumed that the administrative expenses would be recovered by investment earnings in excess of 8% in addition to the \$1 per member charge.



SECTION V

SUMMARY OF BENEFITS AND CONTRIBUTIONS

Effective Date -	July 1, 1945
Member Contributions -	6% of salary
Employer Contributions -	6.417% of active members' salaries.
Retirement Benefit -	<p>Eligibility: Age 60 and 5 years of service; age 65 regardless of service; or 30 years of service regardless of age.</p> <p>Normal Form: Life annuity with a death benefit equal to the balance of accumulated deductions not received by the member as of the date of death (modified cash refund annuity).</p> <p>Benefit: 1/60 of the final compensation for each year of credited service. Contributing members of the System as of July 1, 1973 may retire under the benefit provisions in effect prior to that date (1/60 of the final compensation for each year of prior service plus twice the annuity purchased by the member's accumulated contributions with interest).</p>
Early Retirement Benefit -	<p>Eligibility: Age 50 and 5 years of service or 25 years of service regardless of age.</p> <p>Benefit: Actuarial equivalent of the accrued retirement benefit based upon a retirement age of 60.</p>
Disability Benefit -	<p>Eligibility: 5 years of service and disablement before eligibility for service retirement.</p> <p>Service disability: Members disabled prior to July 1, 1977 receive 25% of final compensation while Industrial Accident Board Compensation is in effect; otherwise, 50% of final compensation.</p> <p>Nonservice disability: 90% of 1/60 of the final compensation for each year of credited service, with a minimum benefit of 25% of the final compensation.</p>

Death Benefit -

Eligibility: Prior to retirement - no requirement. Certain specified terminated or disabled members are also eligible for this benefit.

After retirement - payable according to the option elected.

Normal Form: Return of accumulated contributions with interest if Industrial Accident Board Compensation is paid; otherwise return of accumulated contributions with interest plus 1/12 of final (last 12 months) compensation times number of years of credited service up to a maximum of 6 years.

Termination Benefit -

Prior to completion of 5 years of service, return of accumulated contributions with interest. After completion of 5 years of service, either return of accumulated contributions with interest or the actuarial equivalent of the accrued retirement benefit based upon a retirement age of 60.